LBNL 41919

A Scoping Study on the Costs of Indoor Air Quality Illnesses: An Insurance Loss Reduction Perspective

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August 1998

This work was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098

Abstract

The incidence of commercial buildings with poor indoor air quality (IAQ), and the frequency of litigation over the effects of poor IAQ is increasing. If so, these increases have ramifications for insurance carriers, which pay for many of the costs of health care and general commercial liability. However, little is known about the actual costs to insurance companies from poor IAQ in buildings. This paper reports on the results of a literature search of buildings-related, business and legal databases, and interviews with insurance and risk management representatives aimed at finding information on the direct costs to the insurance industry of poor building IAQ, as well as the costs of litigation.

The literature search and discussions with insurance and risk management professionals reported in this paper turned up little specific information about the costs of IAQ-related problems to insurance companies. However, those discussions and certain articles in the insurance industry press indicate that there is a strong awareness and growing concern over the "silent crisis" of IAQ and its potential to cause large industry losses, and that a few companies are taking steps to address this issue. The source of these losses include both direct costs to insurers from paying health insurance and professional liability claims, as well as the cost of litigation. In spite of the lack of data on how IAQ-related health problems affect their business, the insurance industry has taken the anecdotal evidence about their reality seriously enough to alter their policies in ways that have lessened their exposure.

We conclude by briefly discussing four activities that need to be addressed in the near future: (1) quantifying IAQ-related insurance costs by sector, (2) educating the insurance industry about the importance of IAQ issues, (3) examining IAQ impacts on the insurance industry in the residential sector, and (4) evaluating the relationship between IAQ improvements and their impact on energy use.

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1. Introduction

While most media attention has focused on outdoor air pollution in the last few years, indoor air pollution is typically under-reported and less regulated than its counterpart [e.g., Ott and Roberts 1998]. This is unfortunate because enclosed spaces have high concentrations of indoor pollutants, and people are spending approximately 90% of their time indoors [Apte 1997; Chapin 1974]. A cursory glance at news reports in recent years on buildings with poor indoor air quality (IAQ) suggests that the incidence of buildings with air quality problems, and therefore, the costs of insurance and litigation to redress these problems, are significant, and perhaps rising. Tenants and owners of commercial buildings are bringing IAQ cases against a broad array of defendants associated with building construction or maintenance, from building owners and managers (including insurance companies that own real estate[1]), to contractors, engineers, consultants and leasing agents. The increase in IAQ litigation in the 1980s and 1990s is a new trend, and affects the insurance and risk management communities as well as the self-insured.[2]

Research on the health implications of the indoor environment has shown that there appear to be linkages between the quality of indoor air and the incidence of illnesses (e.g., in a study of 12 public office buildings, the occupants of mechanically ventilated buildings had significantly more symptoms of sick building syndrome (SBS) than occupants of naturally ventilated buildings after adjustment for confounding factors) [Fisk et al. 1993; Fisk and Rosenfeld 1997; Mendell 1993]. Although not precisely defined, SBS is evident in a building when symptoms are unusually severe, frequent, or widespread [Fisk et al. 1993]. Building characteristics may also influence the rate of acute respiratory disease with fever [Brundage et al. 1988].

Research quantifying the costs of IAQ-related illnesses to the insurance industry and other potentially liable parties is scarce. Thus, the primary objective of this study was to answer the following question: what, if any, is the relationship between IAQ-related illnesses in commercial buildings and costs to the insurance industry (including medical and legal costs)?

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[1] U.S. life insurers control nearly $60 billion in real estate and $200 billion in mortgages [Mills 1998].

[2] Prior to the mid-1980s, environmental plaintiffs were most likely to be individuals seeking redress for single-contaminant exposures [Kirsch and Hayle 1997].

A second objective was to ascertain the insurance industry's interest in IAQ issues, and identify potential insurance providers, insurance brokerage companies, risk management firms, or related institutions interested in working with the Indoor Environmental Quality (IEQ) Subcommittee that is developing one portion of the International Performance Measurement and Verification Protocol (IPMVP). The IPMVP is a consensus document for measuring and verifying energy savings from energy-efficiency projects (U.S. Department of Energy 1997).[3] The U.S. Department of Energy (DOE) is interested in developing consensus standards and protocols for improved IAQ in buildings, as part of the IPMVP. The intent of these standards is to improve the health of building occupants, and reduce the exposure of building owners, facilities managers and the insurance industry to liability for IAQ problems. Hence, a related objective of our research was to identify insurance industry concerns in IAQ problems.

This study's focus on IAQ and the insurance industry is part of a larger effort to identify and evaluate energy efficiency-related opportunities to reduce insurance losses [Mills 1996]. Research indicates that technologies and practices that improve the energy efficiency of buildings also improve building safety and occupant health and comfort, resulting in a decline in costs to insurance companies from health and liability insurance claims. For example, out of 36 energy-efficient building improvements examined, at least 18 had insurance loss reduction implications because of their potential to improve IAQ [Mills and Knoepfel 1997].

1.1. Methodology

We searched library data bases on building science, business, law and medicine, and interviewed loss-reduction managers at insurance companies, experts at insurance brokerage and risk management companies, lawyers involved with IAQ-related litigation, and others working with insurance-related professional societies and standards-setting organizations (Appendix A).

We examined the following databases: ABI-Inform; ASHRAE Healthy Buildings/IAQ Meeting Proceedings, 1986-97; Current Contents; Indoor Air Meeting Proceedings, of 1984, '87, '90, '93 and '96; Medline; the University of California Melvyl

[3] The protocol can be downloaded via the World Wide Web: http://www.ipmvp.org,

Magazine and Melvyl Newspapers databases; and the catalog of the University of California School of Law. We also conducted Internet searches for insurance and IAQ information and relevant organizations. A list of useful references and Web sites discovered during the course of this study is presented in Appendix B.

Colleagues provided a number of contacts in the insurance and risk management communities, and we also drew from a list of general insurance industry experts compiled by the Insurance Industry Project of the Center for Building Science. Of course, the literature also provided a number of contacts and legal case citations. A complete list of individuals contacted during the course of this study is provided at the end of the report. A list of individuals and the corporations or professional organizations they represent who are interested in working with the IEQ Subcommittee is presented in Appendix C.

1.2. Organization of Report

In Section 2, we discuss briefly the range of IAQ-related illnesses that have been the subject of public discourse during the last 20 years, focusing on the subset of those illnesses relevant to buildings in the commercial sector. In Section 3, we examine insurance-related costs, including direct costs to insurers from health claims, and costs to workers' compensation funds. We also discuss recent attempts to develop liability insurance products for building owners who want to protect themselves from lawsuits, as well as reasons why there currently is little insurance industry interest in developing more IAQ insurance products. In Section 4, we examine litigation-related costs, and discuss recent major cases involving "sick buildings," what they tell us about the sources of IAQ problems, the evolution of the legal theory, and the civil law underlying this litigation as insurers try to protect themselves from lawsuits. In the final section, we summarize our results and provide suggestions for additional areas of research.

2. Overview of Indoor Air Quality-Related Illnesses

IAQ-related illnesses are known to occur in commercial, residential and industrial buildings. This study focuses on illnesses—sick building syndrome, respiratory diseases, allergies and asthma—that are caused or exacerbated by factors in

commercial buildings. Conditions that cause these illnesses may also be present in other sectors, and, therefore, we briefly describe indoor air quality issues in the industrial and residential sectors.

2.1. Commercial Sector

IAQ-related illnesses in the commercial sector are the focus of this paper because costs and litigation appear to be rising and, as a result, the public and professional awareness of these illnesses has recently emerged. Because IAQ standards and protocols for the office workplace largely do not exist, and data are scarce, we felt there was a need to see if any information on this topic could be collected and analyzed.

The types of illnesses for which we sought cost data in this sector are: sick building syndrome, respiratory illnesses, allergies and asthma. Fisk and Rosenfeld [1997] present estimates of the total costs, including health and lost productivity, of these diseases in the United States in all building sectors. They suggest that the potential annual savings and productivity gains from reduced respiratory diseases are $6 to $19 billion; from reduced allergies and asthma, $1 to $4 billion; and from reduced sick building syndrome, $10 to $20 billion. Their estimates are derived from studies which establish a link between building-related causes and the illnesses in question, but they do not have data on the percentage of these costs paid by the insurance industry, and the estimated benefits cover all building sectors (although the benefits are primarily based on the savings and productivity gains in the nonresidential sector).

One area of concern in the recent literature is schools. Although cost data on the magnitude of the IAQ problem in schools are unavailable, several recent references note that schools are especially likely to have poor indoor air quality. According to the U.S. General Accounting Office, 50% of schools suffer from IAQ problems [EPA 1998]. In another study, Singer et al. [1997] report:

> "... at least 19 percent of U.S. school districts reported unsatisfactory or very unsatisfactory IAQ. Surveys have reported that at least 20 to 25 percent of schools have inadequate heating, ventilating and air conditioning...a school that fails to take actions consistent with existing IAQ guidelines and standards runs the risk that it will be found liable for negligence. The risk is significant because, under negligence theory, a school board's liability is not limited to the costs of remedying the IAQ problem; the board also faces the threat of actual and punitive damages."

The U.S. Environmental Protection Agency (EPA) estimates that 20% of schools exceed the maximum radon allow concentration (4 pCi/L) [EPA 1998]. Capell and Lewis [1997] discuss risks specific to Southern schools, where HVAC problems in old or poorly maintained facilities are exacerbated by the extreme hot and humid conditions of this part of the country.

Finally, Daisey and Angell [1998] recently completed a survey and critical review of the published literature on IAQ, ventilation, and IAQ- and building-related health problems in schools, particularly those in the state of California. They found that measurements of CO_2, often used as a surrogate for occupant-generated pollutants and an indicator of the adequacy of ventilation rates, were very high and indicated inadequate ventilation for pollutant removal. Similarly, they found that measurements in California problem schools suggested that airborne bacterial levels were high enough to indicate inadequate ventilation: e.g., ventilation rates were not high enough to dilute the concentration of bioaerosols (e.g., bacteria, allergens, and fungal spores) that cause infectious diseases, such as influenza, colds, and tuberculosis. They concluded:

> "The cause of many of the ventilation and water-damage problems in schools was inadequate or deferred maintenance, or both, in the buildings and their HVAC [heating, ventilation and air-conditioning] systems. However, in most studies, neither the building and ventilation-system problems nor the specific pollutants have been clearly and unambiguously demonstrated to be related causally to the symptoms." [Daisey and Angell 1998]

Environmental tobacco smoke (ETS) and its possible causation of IAQ-related illnesses offer a large potential for litigation. EPA published a major assessment of the respiratory health risks of passive smoking and concluded that exposure to ETS—commonly known as secondhand smoke—was responsible for approximately 3,000 lung cancer deaths each year in nonsmoking adults and impaired the respiratory health of hundreds of thousands of children [EPA 1993]. The legal aspects of ETS are beyond the scope of this report, but they are evolving rapidly and generating new case law that will affect other IAQ litigation.

2.2. Industrial Sector

Industrial-sector illnesses, although they are a substantial source of costs to health insurance providers and workers' compensation funds, are beyond the scope of this report. In this sector, researchers have studied a wide range of health conditions and illnesses for many years, and they are well-reported in the literature. Arising from specific chemical and physical manufacturing processes, they include mining-related diseases (e.g., black lung and silicosis) and respiratory problems caused by chemicals, gases, fine particles and other fumes in settings ranging from machine shops to high-technology fabrication facilities. Litigation arising from worker exposure to cancer-causing chemicals in the industrial workplace (such as benzene and other organic chemicals) also has a long history. Standards that address these conditions in the industrial workplace include a set of Threshold Limit Values published by the American Conference of Government Industrial Hygienists [ACGIH 1993]. Costs of industrial injuries and illnesses are well-reported in data bases kept by workers' compensation organizations.

A large body of research also exists on asbestos-related pulmonary diseases such as asbestosis, which is often reported among workers in industrial settings (e.g., asbestos mines, processing plants and shipyards) as well as in commercial buildings containing asbestos insulation [Silberfeld 1994]. Claims related to asbestosis are reported in workers' compensation statistics.

2.3. Residential Sector

IAQ-related illnesses are known to be a problem in the residential sector, although costs to insurers have not been well-quantified. Instead, the literature discusses a number of residence-specific health problems, such as carbon monoxide poisonings. In residences, these poisonings are caused most often by the improper indoor use of combustion appliances, or malfunctioning or incorrectly installed gas-burning equipment (e.g., ranges and boilers). Some 1,500 deaths in the U.S. per year are caused by carbon monoxide poisoning, and there were at least 12,000 non-fatal CO poisonings reported in 1993 to the American Association of Poison Control Centers. This is probably a lower limit, since the Association believes that many CO poisonings are never reported, and instead misdiagnosed as flu and other afflictions.

Radon gas provides another example of a known IAQ problem in residences. Four million homes—about 6% of the U.S. housing stock—have radon levels above U.S. EPA safe levels. This contributes to 6,000-18,000 lung cancer deaths annually, although the associated insurance losses have not been estimated [Mills and Knoepfel 1997]. Other factors that cause IAQ problems in the residential sector include environmental tobacco smoke, biological agents that contribute to allergies and asthma, and chemicals such as volatile organic compounds that are implicated as causative factors of sick building syndrome and other health problems [Ott and Roberts 1998]. Research quantifying the insurance costs in residences is almost non-existent.

3. Insurance-Related Costs

3.1. Discussions with Industry Representatives

Both the literature search and discussions with experts in the insurance and risk management communities confirm that information on the costs of IAQ illnesses from health insurance or business liability claims do not exist, or are difficult to obtain. Most sources said that the insurance industry has not seen many claims that unequivocally can be called IAQ-related. Others noted that many claims are settled out of court and remain confidential. As a result, the industry does not recognize indoor air quality as a problem. For example, Randolph Zellis, loss control manager at the Royal Insurance Company, reported the following:

> "We don't have a sort category for indoor air quality or sick building syndrome in our claims database. . . . we go up to 99 loss codes, and I believe this is a standard [database structure] throughout the industry. . . . the codes are very account specific, and will specify something like 'pain in the back from using machinery'." [Zellis 1997]

Zellis has worked in the field for more than 20 years, and the only claims he has seen that are vaguely IAQ-related are for problems like oil mist in machine shops, and welding fumes in metal fabrication shops. According to Zellis, automatic screw machines, producing high volumes of small machined parts like watch bands, cause oil mist problems. He could not recall any office-building related claims, nor were there categories for IAQ in the Royal database. The only way to determine if any of the claims in the Royal records are IAQ-related would be to go through the thousands of

individual claim reports and read the problem descriptions to see if they contain any hints of a building-related origin.

Loss control specialists contacted at other companies (St. Paul Companies, Reliance, Prudential and State Farm) either agreed with Zellis' description of their data base's structure, or searched through their own data bases and could find no relevant information on IAQ-related claims. Ed Gorman of Reliance stated:

> "Generally, SBS issues are related to building construction materials and poor HVAC maintenance. We have done some air quality testing in buildings to measure IAQ problems, but generally, IAQ is not an issue in regards to direct cause of loss on the insurance policy itself. . . . During my career, I've only seen one or two cases of IAQ problems in the northeastern states." [Gorman 1997]

Although it does not address IAQ issues directly, a recent paper by Thomson offers indirect evidence of IAQ's bottom-line impacts on insurance providers [Thomson 1997]. Thomson, an Assistant Vice President with DPIC Companies, reports that DPIC paid out more than $24 million for claims related to heating, ventilation and air conditioning (HVAC) between 1989 and 1993 [Thomson 1997]. DPIC, a provider of professional liability insurance to architects and consulting engineers, examined 44 claims related to faulty HVAC systems in buildings and found that these claims:

> ". . . represent $18.4 million paid out by and behalf of the mechanical consulting engineer and architect policyholders insured with DPIC. The total amount of settlements for these claims was $25.7 million. The remaining $7 million was paid by other parties such as contractors, vendors, other design professionals not insured by us. The average settlement . . . was $584,113, roughly one percent of the building construction value." [Thomson 1997]

The claims involved HVAC systems that over- or under-heated buildings, failed to cool buildings adequately, or failed to adequately ventilate whole buildings, or portions of them. The four most common types of projects in these cases were commercial and industrial buildings, schools and university buildings, condominiums and hospitals.

According to DPIC's overall examination of 8,600 professional liability claims made against building designers, HVAC problems represented 61% of claims dollars paid, and 47% of the total number of claims against mechanical engineers [Thomson 1997]. DPIC believes that building commissioning (application of procedures to ensure that new buildings are functioning according to design specification) in the 44 HVAC-

related cases would have resulted in a significant reduction in claims pay-outs. Since poorly functioning HVAC systems can be a source of poor IAQ, it is reasonable to assume that some of the complaints motivating these liability claims involve IAQ-related health problems. DPIC is considering ways of encouraging building commissioning by its liability insurance policyholders, and other liability insurers have expressed interest in this approach to loss reduction as well.

3.2. IAQ Insurance Products

We came across one policy from an insurance company that addresses indoor air quality and the bodily injuries that may stem from problems associated with IAQ. AIG Environmental, a division of American International Companies, has a package site-specific environmental insurance policy—called Pollution Legal Liability Select[SM] (PLL Select[SM])—that allows the insured to design a program suitable for the insurable risks of a facility (AIG Environmental 1997a). PLL Select[SM] includes on- and off-site coverages for property damage, bodily injury and cleanup costs triggered by pollution conditions. One of the coverages is for on-site pollution conditions which result in bodily injury to third parties while on the insured site. In a case example of an on-site bodily injury covered by this policy, IAQ-related problems are experienced by tenants in a commercial office building (e.g., complaints of headaches, dizziness, fatigue, nausea, rashes and eye problems) (AIG Environmental 1997b). The cause of the airborne contaminants was eventually attributed to several building maintenance errors.

We are also aware of two IAQ insurance policies that are being developed by risk management firms and their partners. The Building Air Quality Alliance (BAQA), a private, not-for-profit group in Philadelphia, is working with a risk management firm to develop an IAQ insurance policy. BAQA has developed a "due diligence IAQ screen" to help building managers reduce their potential liability by completing a checklist protocol to ensure that a building has good indoor air quality practices:

> "The Building Air Quality Alliance's checklist protocol was originally developed by the U.S. Environmental Protection Agency (EPA), the National Institute for Occupational Safety and Health (NIOSH), and more than 50 key organizations to create a viable mechanism for focusing resources on good IAQ management techniques and on healthy indoor environments. It was subsequently privatized and updated by the University Science Center (a high-technology non-profit incubator)....A

> credible and systematic protocol had previously been unavailable. To that end, a BAQA-approved IAQ Screen Course has been developed and has already been presented to one of the largest due diligence firms in the USA." [Lewis 1997a]

BAQA has developed an IAQ risk assessment protocol and an IAQ insurance policy for building owners with the Clair Odell Group, an insurance brokerage firm, and an insurance provider, whose name is currently confidential, but will be revealed when the product is introduced. According to Stu Samuel of the Clair Odell Group:

> "Virtually every general liability policy issued in this country today contains a Pollution Exclusion. . . . Many insurance companies go one step further by attaching an Absolute Pollution Exclusion which contains language even broader than the standard policy exclusion and bars all coverage and indemnification for any environmental claim or occurrence." [Samuel 1997a]

Samuel provided some details of the IAQ insurance policy:

> "[it] will cover a single building and the cost will be based on square footage. . . . [It] most likely won't cover asbestos, lead-based paint, radon, intentional acts, soil, groundwater or underground tanks. . . . One key provision . . . is that to be eligible for it, a building must be a member of BAQA. . . . building owners and individual buildings must go through the BAQA program and maintain their standing in order to renew their policies on an annual basis." [Anonymous 1997]

To qualify for BAQA membership, the building management must implement the BAQA protocol, basically an inspection and checklist related to ventilation and IAQ, once a year.

We asked Samuel about IAQ-related costs in the insurance industry: "I have a nagging feeling that there are a lot of health insurance issues related to IAQ issues in the workplace that up until now are not recognized as such. . . . What really is an issue is going unrecognized—and that's probably where a lot of the costs are right now" [Samuel 1997b]. Samuel argues that these costs are reported as ailments such as flu or colds that are "going around, because maybe, it's flu season. For these chronic problems, I'll bet thousands of people are running around to their personal physicians and getting X-rays and prescriptions for something that could be an IAQ issue. But I don't know how you would separate [IAQ causative factors] out unless you do a ten-year study. . . . For acute issues, those probably turn into an IAQ issue for a building

contractor, an HVAC contractor, or a pesticide sprayer," he says, referring to ailments that have an identifiable cause such as a biological agent or a specific chemical in use in the building. "I think most of the litigation comes from acute incidence rather than from the chronic problems" [Samuel 1997b].

Frank Lewis, Executive Director of BAQA, provided additional reasons for the lack of data, and currently, the lack of wider interest in offering IAQ insurance products or addressing IAQ-related insurance problems: "Most insurance companies are followers. Unlike no-brainer regulation-driven policies, IAQ as a risk management issue has not been properly addressed by the mainstream insurance industry" [Lewis 1997b]. Lewis adds that he has looked and found that there are no industry clearinghouses for data on IAQ claims.

A second IAQ policy is under development by Environmental Resource Process Management (Atlanta) and an unnamed insurance underwriter. The two companies are working to develop a way of assessing IAQ risks in buildings, and to offer a form of liability coverage that would pay for correcting the IAQ problem. Details of this product are still confidential, although Irene Bledel, CEO of Environmental Resource Process Management, indicated that obtaining an IAQ policy would require an integrated building assessment [Katz 1997].

Commenting on the market situation for IAQ insurance, Rodney Taylor of Willis Corroon Environmental Risk Management Services (Nashville) noted: ". . . current IAQ coverage options are flawed in that they fail to provide coverage for policyholders to correct the deficiency that led to the indoor air problem" (quoted in Katz 1997). For example, if mold were growing on parts of a commercial building's air-conditioning system, neither a third-party injury policy nor a first-party property policy would cover the cleaning and removal of the mold (or, presumably, any type of agent that might potentially cause an IAQ problem) [Taylor 1998]. Taylor echoed the assessments of others in the insurance industry that IAQ is a significant but under-reported problem:

> "I think it's a fairly big, but the costs are diffused enough that it's difficult to pin down where they're coming from. I think they're mostly hidden in health and medical benefits, and unemployment insurance. . . . These costs tend to be treated as part of the costs of doing business rather than as costs that are preventable through insurance programs." [Taylor 1997].

He also echoed the opinion of other insurance experts that there were no data bases on IAQ liability.

3.3. Workers' Compensation Funds

The National Council on Compensation Insurance, Inc. (NCCI) compiles statistics on workers' compensation insurance claims for the United States. A list of the "Nature of Injury Codes" is available in the NCCI data base, and, as with data bases at health insurance companies, most of the codes in the NCCI data base refer to specific injuries and diseases; there are no codes for IAQ-related illnesses. The data base is divided into two categories, "specific injury" and "occupational disease or cumulative injury." The former contains only physical injuries. The latter includes a number of ailments like cancer, AIDS, mental disorder, carpal tunnel syndrome and poisoning, but the only respiratory codes are for diseases occurring in the industrial sector: asbestosis, black lung, byssinosis, silicosis, respiratory disorders (gases, fumes, chemicals, etc.), and dust disease (all other pneumoconiosis). Although the last two categories may include some claims from commercial buildings, the reporting form does not contain any fields for reporting type of building, or any details of the incident causing the claim.

A recent article reports that IAQ rarely impacts workers' compensation claims: "Although the topic gets a fair amount of attention in safety and health circles, only rarely do indoor-air quality problems lead to workers' compensation claims" [Anonymous 1996]. In the article, Tim Frazer, CIGNA Property & Casualty's manager of occupational health, asserts that 95% of the complaints referred to CIGNA are sick building syndrome-related, and these are about comfort rather than illness. The other 5% of complaints, building-related illnesses, are "more likely" to generate a valid workers' compensation claim.

Although we did not find much evidence of workers' compensation costs from IAQ-related claims, we believe that these costs, while they may be only a small percentage of all workers' compensation costs, may be significant. Some classes of employee plaintiffs in court cases involving IAQ claims are said to be unable to file claims, or receive limited damage awards because of their coverage by the workers' compensation system:

> "Workers' compensation laws which limit the rights of employees to sue their employers for work-related injuries may bar recovery against employers, forcing employees to seek out third-party defendants to redress their workplace injuries." [Hirsch 1996]

This paper further reports that an employee of New Jersey's Department of Environmental Protection settled a SBS injury-related case for $60,000 under workers' compensation laws. In the litigation over the DuPage County Court House (see Section 4.2), the County filed claims against the building's architects and contractors to recover workers' compensation costs due to sick building-related symptoms. Because a number of companies fund their own workers' compensation funds, insurance companies are not impacted by these liabilities, but these self-insured entities are sensitive to these costs.

Finally, most claims will fall under health insurance and be classified as headaches, flu, or stress-related problems. The biggest impact is probably a loss in productivity through absenteeism and sick time, but not recorded as liability claims (for estimates of improved productivity and health from better indoor environments, see Fisk and Rosenfeld [1997]). Unless an acute situation occurs, people probably are not making a connection between the conditions of the building and their health.

3.4. ASTM, ASHRAE and IAQ Standards

In an interview with Jim Satterfield, United Capital Insurance (and also Chair of the American Society of Testing and Materials' (ASTM) Environmental Risk Management Committee (E51), as well as its subcommittee, Global Sustainability, Healthy Buildings and Pollution Prevention (E50.03)), he noted the following: "At the moment, indoor air quality is not an insurance issue. Everybody thinks that being sued is something that is going to happen to somebody else" [Satterfield 1997]. Satterfield explained that the economics of the insurance field currently work against the creation of more IAQ insurance policy products:

> "The insurance market is very soft right now. There haven't been any major natural disasters in a few years—the industry has recovered from the California earthquakes and Hurricane Andrew—plus it's very easy to make money with the stock market rising. It's not uncommon to find insurance companies whose value has doubled in the last year or two. So there is a tremendous pressure to write premiums. Many companies will

simply include some type of IAQ coverage without charging extra for it." [Satterfield 1997]

Barring some type of market driver, such as a rush of litigation with unfavorable verdicts for the insurance industry, or legislated, mandatory IAQ standards, Satterfield believes that insurance companies will simply write pollution exclusion clauses into their policies to minimize their risk (see Section 4.3). On the customer side, he noted: "No building manager or owner will be willing to increase commercial rents to pay for the higher premiums required to pay for indoor air quality insurance when there's no clear need for it" [Satterfield 1997]. However, he felt that a "green market driver" (i.e., the desire for insurance companies to differentiate their insurance products by IAQ coverage) or some other type of economic driver could create incentives for an IAQ insurance market. In addition, he felt that the mere existence of a standard would be an incentive, especially since no ASTM standard has ever been overturned in court. Therefore, failing to follow "good and customary practice" to maintain good IAQ could create a liability and a basis for a suit against a building owner.

One existing standard that has some relevance to IAQ is ANSI/ASHRAE Standard 62-1989: Ventilation for acceptable indoor air quality [ASHRAE 1989]. This standard prescribes a minimum supply rate of outside air per occupant or square footage, depending on the type of building. The minimum standard is 15 cubic feet per minute (cfm). This is a voluntary standard. The ASHRAE standard and other standards such as model codes can serve as a standard of care, and they are accepted in some states (but not all) as having the force of law.

4. Litigation-Related Costs

4.1. Introduction

The size of settlements awarded to plaintiffs in IAQ-related cases could serve as an indicator of the costs caused by acute building-related problems, as well as of the value that juries place on the damages that building owners, managers and other liable parties owe for neglecting IAQ problems. However, the majority of these cases are settled out of court. Thus, there is no way of totaling the costs of litigation from IAQ cases, although a few individual cases provide useful information on the dollar range of

settlement costs. Some of these cases have also generated important decisions in this relatively new area of environmental law.

It should be noted that litigated cases generally deal with acute IAQ problems in new or renovated buildings that require the relocation of hundreds of employees. Litigated cases are not as likely to involve chronic IAQ problems (e.g., an elevated level of respiratory and other diseases caused by building factors), because these factors are difficult to isolate from other causes. Nonetheless, a few observations about factors common to these acute cases have suggested some starting points toward identifying buildings most at risk [Odom 1996].

4.2. Call vs. Prudential

The first major IAQ-related case argued before a jury was Call. v. Prudential (Super. Ct. Cal, Los Angeles County, No. SWC 90913). Although the case was settled (for a sum rumored to be in the multi-million dollar range) before a verdict was reached, Call generated important IAQ-related law. The plaintiffs in this case were six individuals and two companies with offices in a southern California office building. They alleged that they experienced adverse health effects and loss of business as a result of exposure to noxious chemicals in the building. The plaintiffs charged the defendants with acts of negligence including: (1) using building materials that emitted formaldehyde and other noxious substances, (2) failure to warn them that the building was unsuitable for occupancy because of the noxious fumes and chemicals pervading the premises, (3) failure to provide sufficient fresh air to the building, (4) failure to heed reports of “tight building syndrome” (TBS) and sick building syndrome, and (5) failure to convey information about the health effects of TBS and SBS [Plunkett 1994]. The owner of the building with the alleged IAQ problems was the Prudential Insurance Company. They were named in the suit together with the management company, architect, general contractor, and the companies that installed the HVAC system's components and built the floor where the problems originating the complaint occurred.

The plaintiffs’ attorneys noted that none of the parties examined the indoor air quality issues, and the plaintiffs' expert witnesses testified that the parties could have easily avoided the building’s IAQ problems. The trial court held that the expert witnesses could testify as indoor air quality experts even though they did not practice

locally, making it difficult for the defense to use local construction practices as defense [Hirsch 1995]. The Call case is considered important because, in addition to being the first of its kind to go to trial, it expanded the use of negligence theory to cases of chemicals in the workplace. The Call case extended the chain of liability for problems with the HVAC system not only to the manufacturers and sellers of the system, but to everyone involved in the design and construction of the HVAC system—architects, engineers, installers and anyone else who may have been involved.

4.3. Four Recent Cases Involving Verdicts

Reviews of recent IAQ litigation are cited in the list of references at the end of this report. While a full exposition of the numerous IAQ cases is beyond the scope of this report, we briefly discuss four cases that provide some information on the range of costs in large, commercial building-related judgments. Three of the four cases involved IAQ problems in courthouses, and two of these structures are located in the southeastern U.S. where the climate might have had an impact. The fourth case involved a building in Washington D.C. that was serving as the headquarters of the U.S. Environmental Protection Agency (EPA). The results from these cases are not consistent. In one, the building owner was found to be at fault for the building's problems. In others, the owners received substantial settlements. The lesson is that there is no "typical" IAQ case or rule of thumb indicating how a case will turn out, but they are extraordinarily expensive to try because they require the examination of so much factual information.

4.3.1. DuPage County Courthouse

A courthouse in DuPage County, Ill., was the cause of a number of suits and countersuits involving hundreds of litigants. DuPage County, west of Chicago, constructed a complex of office buildings to house its growing staff. In 1991, shortly after law enforcement and judicial staff occupied the new building, the occupants began to suffer from symptoms characteristic of sick building syndrome—headaches, nausea, dizziness, respiratory irritation. In March 1992, several building occupants were removed by ambulance, and the building was temporarily evacuated. As many as 450 others complained of some of these symptoms [Hirsch 1996]. The first lawsuit was filed

by the occupants of the building against DuPage County to ask for a court order to close the building. Before the case went to completion, the County decided to close the building down itself, vacating it in September 1992. The County then rebuilt the ventilation system.

In 1992, a number of the building's occupants filed a personal injury lawsuit against the architects, general contractors and HVAC contractors, alleging that their illnesses were caused by the design of the ventilation system and the presence of volatile organic compounds (Lake County IL, No. 92L-1695). The County then sued the architects and contractors (Lake County IL, No. 92L-2345), seeking $3 million reimbursement for fixing the building's ventilation system. The County also sought a $1 million reimbursement for its estimated workers' compensation claims [Roberts and Duffy 1994]. Both the County and the personal injury suits alleged that the fault lay with the design and construction of the building's ventilation system, an allegation which was denied by the designers and builders. A jury entered a verdict against the County of DuPage in 1994. The jury rejected the County's claim that the construction and design of the ventilation system was the problem, and found that the County's operation of the system contributed to the employee health problems. As a result of this verdict, the County received no damages for the reconstruction of the ventilation system; no reimbursement for its workers' compensation expenses; no damages from the architects and engineers; and minimal recovery from the contractors for incomplete warranty work unrelated to indoor air quality.

Most of the claims from the individual suits were settled out of court for undisclosed sums [Manko and Cassidy 1996]. Of the many millions of dollars that were spent on the DuPage Court House cases, a substantial portion was used for investigations of the problem, legal fees, building renovation and workers' compensation costs. Because the County's workers' compensation program was self-funded, private insurers were not directly impacted in this case, but the publicity generated by the problems in this building and others provided incentives to insurers and building owners to take sick building complaints more seriously.

4.3.2. Polk County Courthouse

A new Polk County, Florida courthouse was found to cause a number of cases of sick building syndrome, allegedly because of fungi or other microbiological agents breeding in its HVAC system:

> "Following completion . . . building occupants allegedly experienced extensive indoor air quality problems, including personal ailments and building maintenance problems. Rehabilitation costs and other damages have been estimated at $40 million." [Manko and Cassidy 1996].

The county sued several parties including the building's contractor, and in June 1995, a jury ordered Reliance Insurance Co. to pay $25.8 million in damages [McGowan 1996]. The final settlement in the case was for $35 million (due to the accrued interest after a lengthy appeals process) [Katz 1997; Dubarry 1998].

4.3.3. Martin County Courthouse

A courthouse in Martin County, Florida, constructed in 1989, experienced IAQ problems resulting in:

> ". . . required rehabilitation that exceeded $24 million, in large part because the South Florida humidity supported the growth of molds, mildew and fungi on building materials, including vinyl wallpaper. The construction of the courthouse as a sealed building may also have contributed to the problem." [Manko and Cassidy 1996].

The jury in the trial (Martin County v. Frank Rooney) awarded damages amounting to a total of $13.7 million to the county against a construction manager and three surety companies (Centex-Rooney Construction Co., Inc., Seaboard Surety Company, St. Paul Fire and Marine Insurance Company, and the American Insurance Company) (Case No. 96-2537, Court of Appeals of Florida, Fourth District). The County had named other parties in its suit, including the project's architect, mechanical engineer and various contractors, but settled with those parties, reportedly for close to $3 million [Kirsch and Edens 1996]. The cost of rehabilitation exceeded the cost of construction, which was $11 million, and the county had to relocate the building's employees for two years (Martin County, Fl. v. Frank J. Rooney et al. 95-274-CA, Fl. 19th Jud. Cir.) [1996]. Given the

uncertainty in estimating the actual costs of damage, the appeals court upheld the lower court ruling and ruled:

> "Uncertainty as to the amount of damages or difficulty in proving the exact amount will not prevent recovery where it is clear that substantial damages were suffered and there is a reasonable basis in the evidence for the amount awarded. Ultimately, the degree of certainty simply required that the mind of a prudent impartial person be satisfied with the damages." [Anonymous 1998]

4.3.4. EPA Headquarters Building

The U.S. EPA became embroiled in an IAQ-related case when several of its employees alleged that renovations to its Waterside Mall headquarters in 1987-88 caused respiratory problems (Bahura vs. S.E.W. Investors, 90-ca 10594):

> "In Spring 1987, EPA employee Joanne Bahura began to 'experience respiratory problems,' including a cough, scratchy throat, sinus infections, fatigue and dizziness, according to court documents. In October 1987, she was relocated to another area of the building; her symptoms subsided. But they came back when 'renovations in this new area of the building commenced' the documents say." [Foran 1997].

Five employees sued the Waterside Mall operator, alleging that exposure to organics from a new carpet caused these symptoms. In December 1993, the jury awarded nearly $1 million in total to all of the five plaintiffs. After further litigation, the court decided in 1995 that the defendants only had to pay one of the five plaintiffs, who was successful at proving physical injury caused by the IAQ problems [Foran 1997].

4.4. Frequency of IAQ Litigation

It is unclear whether the frequency of these cases is increasing, but lawyers familiar with the field believe so: ". . . more and more IAQ legal claims, especially ones against property owners, are being filed, [according to] Bret W. Reich, a senior environmental attorney with Aon Environmental Risk Services in Houston. He and others . . . could not provide numerical evidence of a rising number of claims" [Katz 1997]. Owen McGowan of the law firm Mitchell, Heinlein and DeSimone also reports:

"Virtually unheard of until the mid-1980s, problems with indoor air quality are growing in frequency and severity" [McGowan 1996]. And Helen Zukin, who represented plaintiffs in the Call v. Prudential case (Section 4.2), notes:

> "We have not seen a tidal wave of litigation because these are expensive cases—the costs for experts are high. . . . However, there is a steady stream of these cases, they are slightly on the increase, [the number is] higher than what we saw five years ago. The buildings that are of most concern are commercial office buildings, hospitals, medical buildings, schools, public buildings, and court houses." [Zukin 1998]

4.5. IAQ Litigation and Building Type

One cannot infer from these few cases about building types that are most prone to acute IAQ problems, but, drawing from past experience, a few lessons have been learned:

> "Building types especially susceptible to failure include schools, laboratories, hospitals and large, complex government buildings. . . . These increased failure rates are usually the result of a combination of several factors, including building usage, specific and unique code requirements and occupant susceptibility to IAQ pollutants." [Odom 1996]

In addition, new buildings appear to be slightly more prone to IAQ failure than old ones, since design problems that cause episodes of poor indoor air quality generally show up within a structure's first year [Odom 1996]. It appears that specialized buildings (such as, laboratory facilities, hospitals, and universities) may be prone to IAQ problems because of their complicated and specialized HVAC systems. Also, buildings in the southeastern U.S. have IAQ concerns because of the hot, humid climates and other harsh conditions during the region's extended summer. Finally, it is important to note that changes in building usage density can also cause IAQ problems. Although these changes alter heating and cooling load, they often take place without appropriate changes to the HVAC system.

4.6. Development of IAQ Legal Theory

The first type of indoor air quality litigation concerned industrial settings and single-source contaminant exposures. Prior to the first IAQ claims in the commercial sector, most building owners were more concerned with liabilities from asbestos, lead paint and other specific chemical hazards. In the residential sector and, to a lesser degree, in commercial buildings, a number of cases arose from exposure to formaldehyde emissions from building materials such as particle board and insulation [Silberfeld 1994]. Faulty appliances leaking dangerous fumes such as carbon monoxide were another source of lawsuits in the residential sector [Kirsch and Hayle 1997].

In the early 1980s, commercial building owners relied on insurance coverage for sudden, accidental emissions of pollution for liability protection. Later, some courts began to find that the language in these policies referred only to "traditional" air pollution (i.e., outdoor air pollution), even though the policies technically covered all emissions to the atmosphere. Around 1986, insurance carriers began writing pollution exclusion clauses into their general liability policies to avoid their contractual obligations. The exclusion exempted coverage of emissions that might cause various IAQ problems, including sick building syndrome and general respiratory conditions caused by the indoor environment, as well as asbestos-related health problems and lead paint [Anderson 1995]. This clause is sometimes referred to as the "absolute pollution exclusion" clause (see Section 3.2). The absolute pollution exclusion clauses were originally designed in response to environmental pollution exposures; insurance companies later tried to include IAQ problems under the same exclusion [Frazer 1998]. Although businesses can buy specific types of insurance to handle asbestos and lead paint problems, most insurance companies now write their commercial general liability policies in a way that excludes many IAQ-related claims. In spite of the lack of data on how IAQ-related health problems affect their business, the insurance industry has taken the anecdotal evidence about their reality seriously enough to alter their policies in ways that have lessened their exposure.

It is unclear to what extent courts in all jurisdictions will allow insurance companies to use pollution exclusion clauses to refuse coverage of indoor pollution-related problems. In some cases, courts have decided in favor of insurance companies; in other jurisdictions, courts have rejected the use of pollution exclusions to deny coverage in cases involving lead paint and floor resurfacing chemicals. For example, the North Carolina Court of Appeals decided that a floor resurfacing chemical was not a

"pollutant" as defined under the absolute pollutant exclusions—they are desired by the property owner and intentionally introduced to form part of the building [Anderson 1995]. Irene Bledel, CEO of Environmental Resource Process Management, notes that changes are occurring in several areas:

> "Based on present case law, the courts are ruling in favor of the insured versus the insurance companies. Therefore, the 'absolute pollution exclusion' is being questioned by the courts. It is not only the real estate developers, owners, investors, tenants, users, consultants, and service providers of commercial space that have an IAQ/SBS liability exposure. The insurance companies are also at a potential loss—a loss they have not documented or planned for in their cross-disciplinary risk data management systems and product cross-functional coverage exposure." (Bledel 1998)

Pollution exclusions have given insurance companies a legal tool to limit their liability in many environmental cases involving IAQ as well as lead paint, asbestos and formaldehyde insulation. When this tool fails and a court allows a case to go forward, many insurance companies will find settling out-of-court preferable to the possibility of a plaintiff receiving a large award from the jury, as described by Jonathan Larsen, a lawyer with a San Francisco practice in toxic torts: "Until these pollution exclusions, insurance companies probably paid for most of the damages awarded during litigation" [Larsen 1997].

Almost any party associated with building construction or maintenance may be named as defendants in a suit, including building owners, managers, real estate developers, architects, engineers, general and HVAC contractors, manufacturers of building products, IAQ and energy management consultants and leasing agents. In the past, plaintiffs were individuals seeking redress for single-contaminant exposures; today, plaintiffs are most often commercial entities such as the tenants or owners of a commercial building [Kirsch and Hayle 1997].

Lawyers are escalating the "legal arms race," looking for other precedents on which to base IAQ suits [Silberfeld 1994]. The most common areas of law they use today are: (1) contracts and breach of lease; (2) professional malpractice or negligence; (3) strict liability, generally used against product manufacturers; (4) fraud or misrepresentation; or (5) punitive damages, for punishing the defendants.

Cases based on the provisions of the Americans With Disabilities Act (ADA) are also on the rise, particularly in claims related to multiple chemical sensitivities (MCS). Although many insurers and medical experts do not recognize MCS as a disease, the U.S. Department of Housing and Urban Development determined in 1992 that MCS was a "handicap" under the Fair Housing Act. Although the legal status of MCS is still far from clear, some courts interpreting ADA law have found that MCS can be called a "disability" under ADA, and this may open the door to ADA-based IAQ claims. Workers' compensation could also become a larger factor in IAQ litigation, since many state legislatures have loosened restrictions on what is defined under workers' compensation regulations as an occupational disease [Williams 1997].

5. Summary and Conclusions

5.1. IAQ Awareness

The literature search and discussions with insurance and risk management professionals turned up little specific information about the costs of IAQ-related problems to insurance companies. However, those discussions and certain articles in the insurance industry press (e.g., rulings on the absolute pollution exclusion clause) indicate that there is a strong awareness and growing concern over the "silent crisis" of IAQ and its potential to cause large industry losses. The source of these losses include both direct costs to insurers from paying health insurance and professional liability claims, as well as the cost of litigation.

The insurance industry as a whole does not yet see IAQ as a major source of claims, as reflected in the structure of its claims data bases: e.g., companies contacted for this report do not have data fields for any type of IAQ-related condition. However, several insurance industry observers agree that IAQ costs may well be unrecognized, and instead ascribed to more conventional and, therefore, easily reported medical conditions, such as respiratory ailments, allergies, and asthma. A substantive examination into the thousands of claims reports on file at insurance companies might reveal building-related origins of these problems.

Although there are no figures for total costs due to unfavorable judgments in IAQ lawsuits (because so many of these suits are settled out of court and remain confidential), sizable awards in several recent cases suggest that defending parties,

including insurance companies, could be liable for tens of millions of dollars per building. Although the insurance industry has made efforts to limit IAQ losses through the use of pollution exclusions, not all states have found these exclusions valid, and lawyers are finding other legal theories on which to base IAQ lawsuits. The fact that insurance companies began writing these exclusions in the same timeframe as the growth in litigation on IAQ-related health problems suggest that they do recognize potential problems for their business posed by poor IAQ.

Finally, because of their interest in this topic, several professionals at insurance brokerage and risk management firms, professional and nonprofit associations, and legal firms have expressed interest in working with DOE's IEQ Subcommittee in developing consensus standards and protocols for improved IAQ in buildings (see Appendix C).

5.2. Future Activities

We conclude by briefly discussing four activities that need to be addressed in the near future: (1) quantifying IAQ-related insurance costs by sector, (2) educating the insurance industry about the importance of IAQ issues, (3) examining IAQ impacts on the insurance industry in the residential sector, and (4) evaluating the relationship between IAQ improvements and their impact on energy use.

5.2.1. Quantify IAQ-related insurance costs by sector

Future work in quantifying insurance costs could follow three tracks. First, to quantify IAQ costs more accurately, DOE might approach a few insurance companies with a large health insurance or commercial general liability business and ask whether they would be willing to open their claims forms to researchers, or convince a company to conduct an internal claims-review study focused on IAQ (e.g., as DPIC examined its own HVAC-related professional liability claims, see Section 3.1). By working through the individual reports, researchers might be able to identify which claims had an origin in an IAQ-related factor. This might provide an estimate of the percentage of the insurance carrier's payments related to IAQ.

A second approach to quantifying these costs is to work with an organization like the Building Air Quality Alliance (see Section 3.2) or the Building Owners and Managers Association to develop a data base of buildings, their IAQ problems, and costs to building owners and their insurance carriers. These organizations could serve as gateways to building managers who are paying attention to IAQ issues. The challenge is to access a large, robust sampling of commercial buildings—without this, there is the potential to produce a biased statistical representation of these costs.

A third method of characterizing insurance costs is to first estimate the total health insurance cost of adverse health effects that are influenced by indoor air quality, and then estimate the proportion of these costs that are directly attributable to IAQ. Such an approach would also require cooperation with the insurance industry to pull data from health claims databases and to draw on industry professionals' sense of the orders of magnitude of claims for various health conditions.

5.2.2. Educate the insurance industry about the importance of IAQ issues

In protocol and standards-related work, there is a need to determine for the insurance industry whether or not attention to IAQ problems will help their bottom line. Although there is a perception of increasing frequency of IAQ litigation, only a few cases have gained media attention. Thus, there is a contradictory perception among both insurance underwriters and building owners that “it won't happen to me.”

Working with the risk management and brokerage firms, and professional societies listed in Appendix A, there is an opportunity to raise the awareness of the large insurance carriers that IAQ issues can impact their bottom line, and that there are steps they can take in such areas as standards development to reduce that impact.

5.2.3. Examine IAQ impacts on the insurance industry in the residential sector

Future research is needed to examine IAQ impacts on insurance claims in the residential sector, beginning with a review of literature and the insurance industry's knowledge of these impacts. In addition to the IAQ-health linkages shared with the commercial sector, the residential sector could have unique linkages (e.g., a higher rate

of carbon monoxide poisonings caused by faulty combustion appliances) [Ott and Roberts 1998].

5.2.4. Evaluate the relationship between IAQ improvements and energy use

Research should not neglect the energy implications of improving IAQ to reduce insurance loss. Some measures that improve IAQ also increase energy efficiency. With careful optimization, building improvements can help raise both its IAQ and its energy efficiency.

Acknowledgments

We are especially grateful for the financial and moral support provided by Gregory Kats and Art Rosenfeld of the U.S. Department of Energy. We are especially indebted to Evan Mills at LBNL for his guidance, support and efforts in developing this study. The authors also wish to thank the people who were interviewed for this study as well as Irene Bledel, Bill Browning, Rick Diamond, William Fisk, Tim Frazer, Cathy Ghandehari, Gregory Kats, Satish Kumar, Hal Levin, Evan Mills, and Art Rosenfeld for their helpful reviews on an earlier draft of this report. Support for this work was provided by the Assistant Secretary for Energy Efficiency and Renewable Energy of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

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Appendix A

List of Interviews

Contact person/position	Company	Phone number
Insurance and risk management companies		
Irene Bledel President and CEO	Environmental Resource process management, LLC	(404) 885-6661
Dave Burkhardt Industrial hygienist	Reliance	(215) 864-4490
Rebecca Craft	Prudential	(201) 802-2118
Ed Gorman Loss control manager	Reliance	(203) 657-7240
Jim Mann Industrial hygienist	Royal	(704) 522-2673
Stu Samuel	Clair Odell Group	(610) 825-5555
Jim Satterfield Loss control manager	United Capital Insurance	(770) 677-0321
Jeff Schaffer Operations Specialist, Loss Control	St. Paul Companies	(612) 310-2729
Rodney Taylor	Willis Corroon Environmental Ris Management Services	(615) 872-3261
Randolph Zellis Loss control manager	Royal	(215) 238-7430
Roger Wid Head of Research	State Farm	(309) 766-5945
Law firms		
Jonathon Larsen	Sarrail, Lynch & Hall	(415) 398-2404
Laurence S. Kirsch	Cadwalader, Wickersham & Taft	(202) 862-2200
David Williams	Cadwalader, Wickersham & Taft	(202) 862-2308
Professional groups:		
Susan Canning Committee liaison	American Society of Testing and Materials, Environmental Risk Management Committee	(610) 832-9500
Lance Ewing Loss control administrator	Risk and Insurance Management Society, Health and Safety Com	(215) 299-4981
Mike Helvacian	National Council on Compensatic Insurance, Inc.	(201) 222-0500
Frank Lewis Executive Director	Building Air Quality Alliance	(888) 704-2577 (215) 387-6324
Carlton Vogt Editor	IEQ Strategies' Managing Risk	(603) 664-6942

Appendix B

Web Sites

The sites listed here are all reachable through Energy Crossroads:

http://eetd.lbl.gov/CBS/eXroads/EnergyXroads.html

Company	Web Address	Comments
American Conference of Governmental Industrial Hygienists	http://www.acgih.org/	
Building Air Quality Alliance	http://www.baqa.org/Rdefault.htm	
Cadwalader, Wickersham & Taft	http://www.cadwalader.com/	
Cadwalader, Wickersham & Taft	http://www.cadwalader.com/main_prac_areas.html	Overview of environmental law practice
Clair Odell Group	http://www.clairodell.com/	
Enviros: The Healthy Buildings Newsletter	http://www.envirovillage.com/Newsletters/Enviros/RDefault.htm	
Enviros: The Healthy Buildings Newsletter	http://www.envirovillage.com/Newsletters/Enviros/RReverseChronological.htm	A reverse chronological listing of articles
FacilitiesNet	http://www.facilitiesnet.com/guest/LI/LI2iaq.html	A good outline of basic IAQ for facilities
FacilitiesNet	http://www.facilitiesnet.com/guest/LI/LI3water.html	A description of the Waterside Mall case
Powell, Goldstein, Frazer & Murphy	http://www.pgfm.com/newsletters/ltrend/airquality.html	A good overview of IAQ and legal
Risk Insurance Management Society	http://www.rims.org/index.html	
Willis Corroon Group	http://www.wcg.co.uk/wcinfo.html	

Appendix C

Sources Interested in Working with the IPMVP's IEQ Subcommittee

Contact person/Company	Address	Phone/Fax
Irene Bledel (President and CEO) Environmental Resource process management, LLC	1401 Peachtree St., NE, Suite 500, Atlanta, GA 30309	(404) 885-6661
Laurence S. Kirsch, Esq. Cadwalader, Wickersham & Taft	1333 New Hampshire Ave. NW, Washington DC 20036	(202) 862-2200
Frank Lewis Building Air Quality Alliance	University Science Center, 3624 Market St., Philadelphia, PA 19104	(888) 704-2577 / (215) 387-6324 Fax: (215) 387-6324
Stu Samuel Clair Odell Group	120 West Germantown Pike, Plymouth Meeting PA 19462	(610) 825-5555 Fax: (610) 825-8149
Jim Satterfield United Capital Insurance (Chairman of ASTM's Environmental Risk Management Committee (E51))	400 Perimeter Center Terrace, Suite 345, Atlanta, GA 30346	(770) 677-0321 Fax: (770) 399-6547
Richard Strano (Exec. Dir.) American Conference of Governmental Industrial Hygienists	1330 Kemper Meadow Drive, Suite 600, Cincinnati, OH 45240	(513) 742-2020 Fax: (513) 742-3355
Rodney Taylor (Sr. Vice President) Willis Corroon Environmental Risk Management Services	26 Century Blvd., Nashville, TN 37214	(615) 872-3261